REMARKS

The Office Action of October 1, 2010, has been carefully studied. Claims 17, 20 and 22-35 currently appear in this application. These claims define novel and unobvious subject matter under Sections 102 and 103 of 35 U.S.C., and therefore should be allowed. Applicant respectfully requests favorable reconsideration and formal allowance of the claims.

Claim Amendments

Claim 1 has been amended to emphasize that the parts that are to be co-welded are three-dimensional parts.

Art Rejections

Claims 17, 20, 22-24, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Beer et al., Us 2002/0104614 in view of Sonntag, DE 20001033. The Examiner concedes that Beer is silent as to additionally and simultaneously exposing the transmissive join partner in the weld area to an electromagnetic secondary radiation selected from the group consisting of IR and UV radiation for selective temperature increase of the welding area such that the temperature in the weld area is homogenized with respect to the molten phase. The Examiner alleges that Sonntag discloses the combination of using a laser source and a polychromatic light source to heat a treated surface.

This rejection is respectfully traversed.

It is respectfully submitted that Sonntag does not supply the missing element in Beer, namely, additionally and simultaneously exposing the transmissive join partner in the weld area to an electromagnetic secondary radiation selected from the group consisting of IR and UV radiation for selective temperature increase of the welding area such that the temperature in the weld area is homogenized with respect to the molten phase.

Sonntag clearly discloses the use of two different light sources to generate heat radiation, namely, a polychromatic and a monochromatic light source. This is clearly shown in the embodiments according to Figures 1 through 3, showing a semiconductor diode laser (5) as a monochromatic light source and a halogen lamp (2) s a poly chromatic light source.

Although it can possibly be inferred from the figures that the material (8) is simultaneously irradiated by both light sources, the Sonntag disclosure makes it clear that this is not the case.

The examiner has supplied a Derwent translation of Sonntag. Submitted herewith is a certified translation of Sonntag.

In the Sonntag specification (Derwent translation) at page 6, beginning at line 1, it is stated that the invention is based on the idea to achieve maximal desirable temperature values of the limited heating processes in a m**ultiple** number of steps of irradiation of various kinds. The process is carried out in **at least two phases**. During a preparation phase the effective area is **preheated** with polychromatic radiation, wherein the maximum heating

temperature is lower than the specified maximum temperature. The locally limited maximum temperature at the affected area is generated by monochromatic laser light. As the temperature difference between preheating temperature and maximum temperature is low, the advantages of laser light can be utilized in the case of selective hearting. [emphasis added]

In the certified translation, page 6, lines 14-19, "The invention is based on the idea to reach desired maximum temperatures with localized heating processes in several stages using radiation sources of different kin. **The whole process is run in at least two phases**. During the preliminary phase, the point of operation is preheated with polychromatic radiation wherein the maximum preheating temperature is below the desired maximum temperature." [emphasis added]

Sonntag teaches first preheating the material and then further hating to the maximum temperature in two steps or phases. This two-step process is drawn like a continuous line through the disclosure of Sonntag as follows:

> Page 6 of the Derwent translation, beginning at line 16, "First of all, the effective spot is preheated with the help of the halogen lamp."
>
> Page 7, beginning at line 3, "As a result of the preheating with halogen light, the laser power (output) can be dimensioned so that it will be less than in the case when the heating is done exclusively by means of a laser source. "
>
> Page 8, beginning at line 2, "An advantageous embodiment of the invention is provided in..." claim 2. The refinement in accordance

> with claim... 2 provides an opportunity for use of cost-effective polychromatic sources of irradiation for the preheating.
>
> Page 11, beginning at line 4, "The components of the circuit elements or circuit elements of the printed board (1) or mounting plate are **preheated** with the light of a halogen lamp (2), and, subsequently, soldered up with the help of monochromatic light, which is generated by a diode laser (5)." [emphasis added]

The certified translation of Sonntag confirms this requirement for at least two heating steps:

> Page 6, lines 5-7, "By the preheating with halogen light the laser performance may be sized lower than in exclusive heating by a laser source. "
>
> Page 6, lines 25-29, ".The further design according to claim 2 allows the use of cost-effective polychromatic radiation sources for **preheating**." [emphasis added]

The above quotations from the Derwent translation of Sonntag make it clear that Sonntag does not disclose or even suggest a simultaneous exposure of the affected area to two light sources.

In order to visualize the process disclosed by Sonntag, attached hereto is a sketch on which the exposure of the thermoplastic absorptive material to a polychromatic light source between times t_1 and t_2 and subsequent exposure to laser light between times t_2 and t_3, is depicted together with a time-temperature diagram. From these sketches, it is clear that the thermoplastic absorptive material, which is to be heated up, is primarily preheated (yellow part of the temperature graph), whereas, afterwards, the actual melting process by

means of laser light takes place. This latter is shown in the orange part of the temperature graph in the diagram.

It is respectfully submitted that the process claimed herein is not obvious for the following reason:

1. The laser through transmission is part of the claimed process, which feature is shown in Beer. However, as has been explained in both the original application documents and all of the responses filed in the USPTO, a specific problem of this welding technique lies in the heat transfer from the laser absorptive material to the transmissive material. The transmissive material must be heated and melted by heat transfer from the absorptive material melting under the influence of the laser as the laser radiation is not absorbed by the transmissive material located on top of the absorptive material. This makes the so-called "process window" both sophisticated and critical. A discussion of the temperature filed in the welding area is visualized by Figures 2, 3 and 4, and is described in the specification at page 8, paragraph 3, as follows:

> The treatment head 4, together with the clamping roller 10, moves along the outline K in the feed direction 13, acting on the two join partners 1,2, the top outline K in the feed direction 13, acting on the two join partner 1 of which being locally heated by the leading secondary radiation in the respective welding area 18. Consequently, for initially melting the top partner 1, less heat energy is needed by the (bottom) absorbing join partner 2 in order to obtain an integral union of the two partners 1, 2 by the lagging laser welding beam 3. Figs. 3 and 4 explain the above effect of the secondary radiation 15. Fig. 3 shows the simulated temperature field of a conventional laser welding process of

> polyethylene (PE) without secondary radiation. The molten phase, shown as a white area in Fig. 3, extends primarily in the bottom, absorptive join partner 1, its extension in the top, transmissive join partner 2 being inferior. This means that the process window is very narrow, any integral union by the welding process window being no longer ensured when the conditions of heat transfer from the bottom join partner 1 to the top join partner 2 deteriorate only slightly. A reason therefor may for instance reside in increased welding gaps.

The presently claimed method requires **additionally and simultaneously** exposing the laser transmissive join partner in the welding area to an electromagnetic secondary radiation from a source different from the laser in order to homogenize the temperature field in the welding area.

The effect of simultaneously exposing the welding area is shown in the time-temperature diagram attached hereto leveled "Invention", in which the graph of the temperature-absorptive material T_A is depicted in orange and the graph of the temperature T_T in the transmissive material is shown in yellow. As can clearly be seen in this diagram, the temperature in the transmissive material is raised by the secondary radiation, whereas the temperature in the absorptive material is raised by the laser radiation. As both types of radiation are supplied simultaneously, the temperature gap between the transmissive and the absorptive material is reduced, thus making the process window for through transmission welding less critical.

The simultaneous exposure of the laser transmissive join partner is in clear and direct contradiction of the disclosure of Sonntag, because Sonntag requires a preheating step by means of a secondary radiation and a subsequent laser irradiation step for implementing the melting process. Thus, Sonntag fails to supply the element missing from Beer.

Claims 17, 20, 22-24, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Muelich, US 5,893,959 in view of Sonntag. The Examiner admits that Muelich is silent with respect to additionally and simultaneously exposing the partner (7) in the weld area to secondary electromagnetic radiation from a source different from a laser.

This rejection is respectfully traversed.

As explained at length above, Sonntag does not cure the deficiencies in Muelich. Accordantly, Sonntag in combination with Muelich does not render the presently claimed method obvious, as there is no disclosure or suggestion of simultaneously treating the material with both a laser beam and electromagnetic radiation.

Claims 17, 20, 22-24, 34 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chen et al., US 2003/0213552 in view of Sonntag.

This rejection is respectfully traversed.

As explained at length above, Sonntag does not cure the deficiencies in Muelich. Accordantly, Sonntag in combination with Chen does not render the presently claimed method obvious, as there is no disclosure or suggestion of simultaneously treating the material with both a laser beam and electromagnetic radiation.

In view of the above, it is respectfully submitted that the claims are now in condition for allowance, and favorable action thereon is earnestly solicited.

Respectfully submitted,

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